Project Controls EXPO
Melbourne, Australia

Artificial intelligence in the construction industry – what you need to know and how to apply it to your projects

About the Speaker

Experience / Qualifications

- BHP
- Origin Energy
- Turner and Townsend
- Faithful and Gould
- Tier 2, and 3 Contractors
- MRICS
- BSc QS, BSs (Hons) QS
- ACES, Member and Vice Chair


DAIHATSU


CAUTION
TAM

EDTYRES.

SEARCH

MENU

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Simply search by **tyre size or brand**

SEARCH

HOW TO BUY TYRES

Search

Book

Schedule

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Skills

- Planning and Scheduling
- Building Information Modelling BIM, DE or VDC
- Contracts and Claims
- Risk Quantification/Integration
- Agile Project Management

Presentations/Articles and Publications

- Inclusion and Diversity in the Mining Industry, Presentation and Panelist - University of Queensland, Diversity Call Seminar, 2015
- Optimization of profit for SME Contractors by implementation of internal control measures, Treatise, University of Pretoria, 2008
- Able and Agile, Article, RICS International Construction Journal, 2016
- Visualizing Risk in Augmented reality with the Microsoft Holoens – 2017
- Using 4D and augmented reality to manage projects, Fishburners Brisbane, 2016
- BILT ANZ, Construction 3.0 - How Artificial Intelligence will change what we do as Construction Professionals, Presentation and Article, 2018
- Delivering projects using 4D and Augmented Reality, AACE NSW, 2017
- Using a Time Machine to deliver projects - AACE QLD, 2017
- Applying BIM planning workflows to Architecture, Guest Lecturer, University of Queensland, 2017
- Using 4D planning and augmented reality on construction projects, Queensland University of Technology (QUT), 2017

John Mirchin – Geometry Gym

Presentation Developed with

& Josh Shanahan

VIRTUAL CONSTRUCTION

Why Project Controls?


PRESENT
FUTURE
PAST


Plan A
Plan B

- video

World is changing

Question to crowd

1. AI has transformed other industries. Those who adopted it gained and those who opposed lost

2. AI is transforming Construction

3. You can adopt AI

Q: Will you adopt it?


9:41
Tuesday, September 12

2010

Third quarter [61]	
Exxon Mobil	▲403,366
PetroChina	▼325,097.5
ICBC	▼237,951.5
Microsoft	▲229,630.7
HSBC	▲198,561.1
China Mobile	▼195,680.4
Wal-Mart	▲189,331.6
Petrobras	▲189,027.7
China Construction Bank	▲186,816.7
Royal Dutch Shell	▲175,986.1

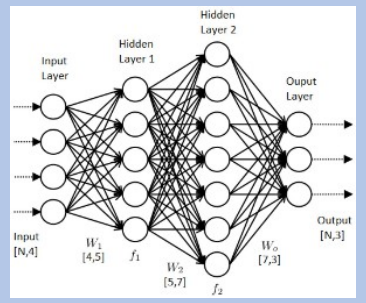
2018

Third Quarter	
Apple Inc.	▲1,091,000[10]
Amazon.com	▲976,650[11]
Microsoft	▲877,400[12]
Alphabet Inc.	▲839,740[14]
Berkshire Hathaway	▲523,520[17]
Facebook	▼473,850[16]
Alibaba Group	▼423,600[18]
Tencent	▼388,080[15]
JPMorgan Chase	▲379,440[19]
Johnson & Johnson	▲370,650[20]


We live in a
data driven
world


MetLife
verizon
10

Deep Learning



Machine Learning

Machines improve over time through self-learning

Artificial Intelligence

Machines achieve complex goals through programming

Four focus areas of AI for this presentation

- Natural Language Processing
- Image recognition
- Predictive analytics
- Genetic Algorithms

Video

For a machine to understand that image

- Process 4608 x 2592 x 256 = 3,057,647,616 pixels
- Orientation of pixels in relation to one another
- Understand tone difference
- Transfer 2D image to 3D outcome

4cast4d | TheOval.club Sl

Pieter Pedro Rautenbach

Secure | https://www.facebook.com/photo.php?fbid=10156149718981171&set=pb.597766170.-2207520000.1526536788.&type=3&theater

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in Mobile Uploads

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Yes · No

Like Comment Share Tag photo Options

Pieter Pedro Rautenbach
11 March ·

Add a description

Tag photo | Add location | Edit

Like Comment Share

Alireza Varasteh and Rae Parker

Jim Hegerty Wrong colour jersey for the bulls. But he looks like he will get a start.
Like · Reply · 9w

Leah Sharman Look at him!!!! ❤️
Like · Reply · 9w

Write a comment...

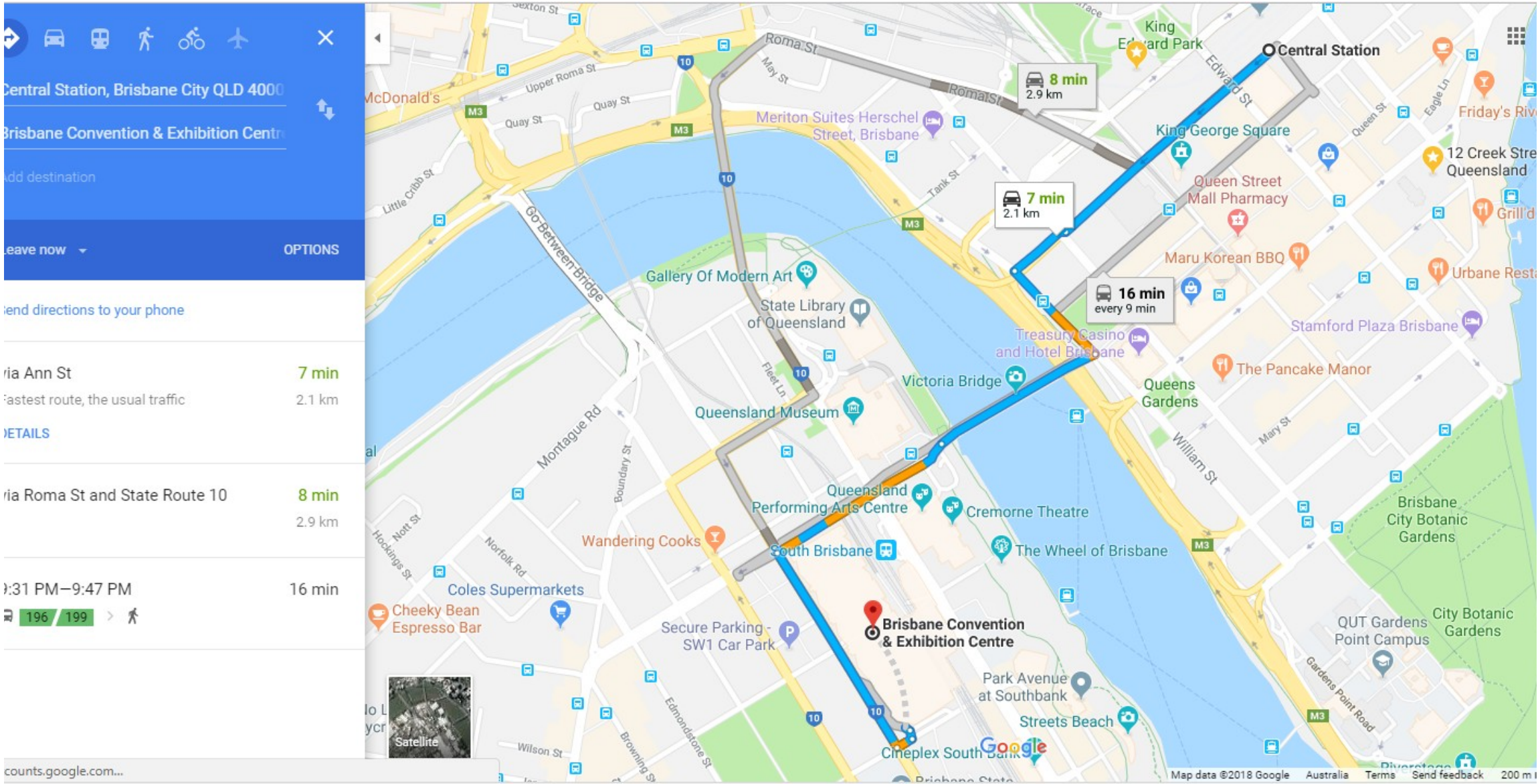
Suggested Groups See All

Face
6,36

COBieChallengeMo....ifc
41.4/106 MB, 4 mins left

4:00 PM
17-May-18

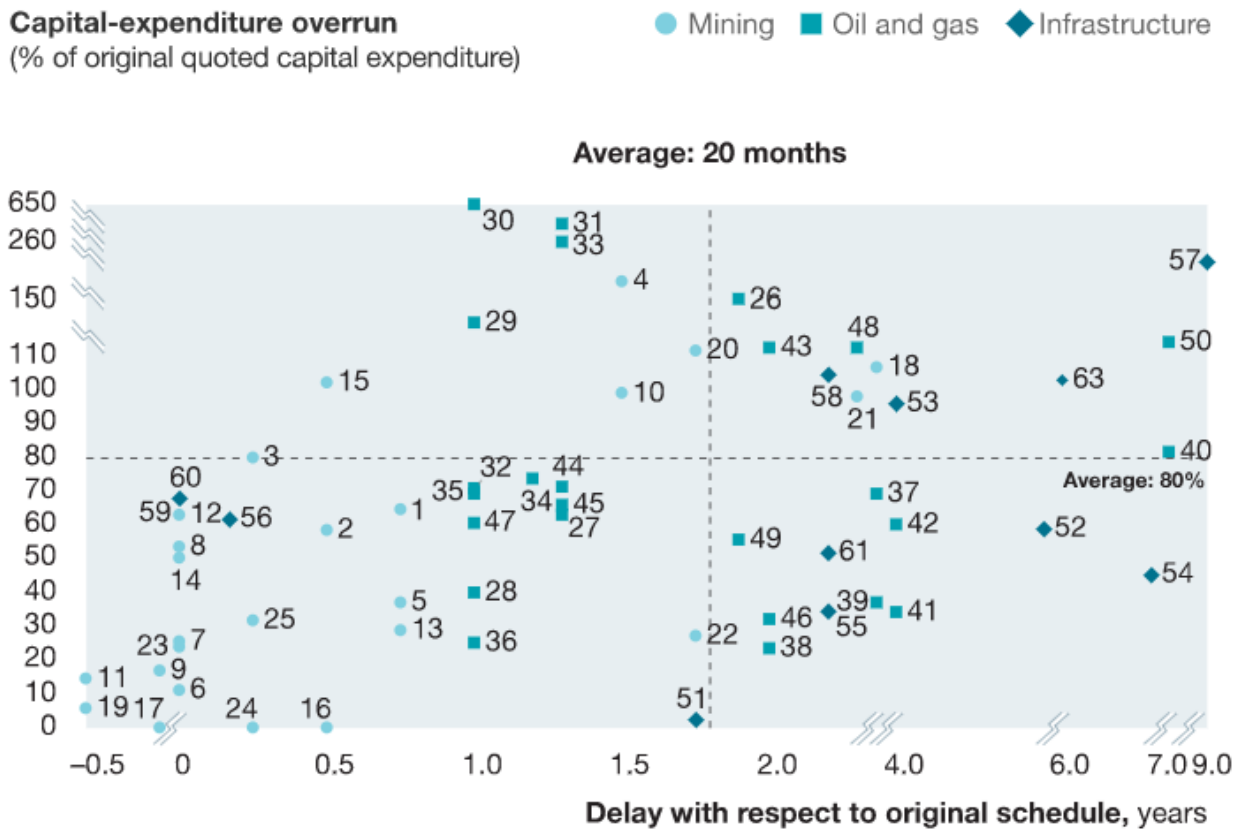
Type here to search


Central Station, Brisbane City QLD 4000
Brisbane Convention & Exhibition Centr
Add destination
Leave now
OPTIONS
Send directions to your phone
via Ann St
7 min
Fastest route, the usual traffic
2.1 km
DETAILS
via Roma St and State Route 10
8 min
2.9 km
9:31 PM–9:47 PM
16 min
196
199
8 min
2.9 km
7 min
2.1 km
16 min
every 9 min
Central Station
King George Square
Queen Street Mall Pharmacy
Maru Korean BBQ
Stamford Plaza Brisbane
The Pancake Manor
Queens Gardens
Treasury Casino and Hotel Brisbane
Victoria Bridge
Gallery Of Modern Art
State Library of Queensland
Queensland Museum
Queensland Performing Arts Centre
Cremorne Theatre
The Wheel of Brisbane
South Brisbane
Wandering Cooks
Coles Supermarkets
Cheeky Bean Espresso Bar
Secure Parking - SW1 Car Park
Brisbane Convention & Exhibition Centre
Park Avenue at Southbank
Streets Beach
Cineplex South Bank
QUT Gardens Point Campus
Brisbane City Botanic Gardens
City Botanic Gardens
Meriton Suites Herschel Street, Brisbane
McDonald's
Friday's
Grill'd
Urbane
Roma St
Upper Roma St
Quay St
Go Between Bridge
Little Cribb St
Tank St
Montague Rd
Boundary St
Fleet Ln
Edward St
Queen St
Eagle Ln
Mary St
William St
Gardens Point Road
Satellite
Map data ©2018 Google
Australia
Terms
Send feedback
200 m

Video

So What! We work in Construction

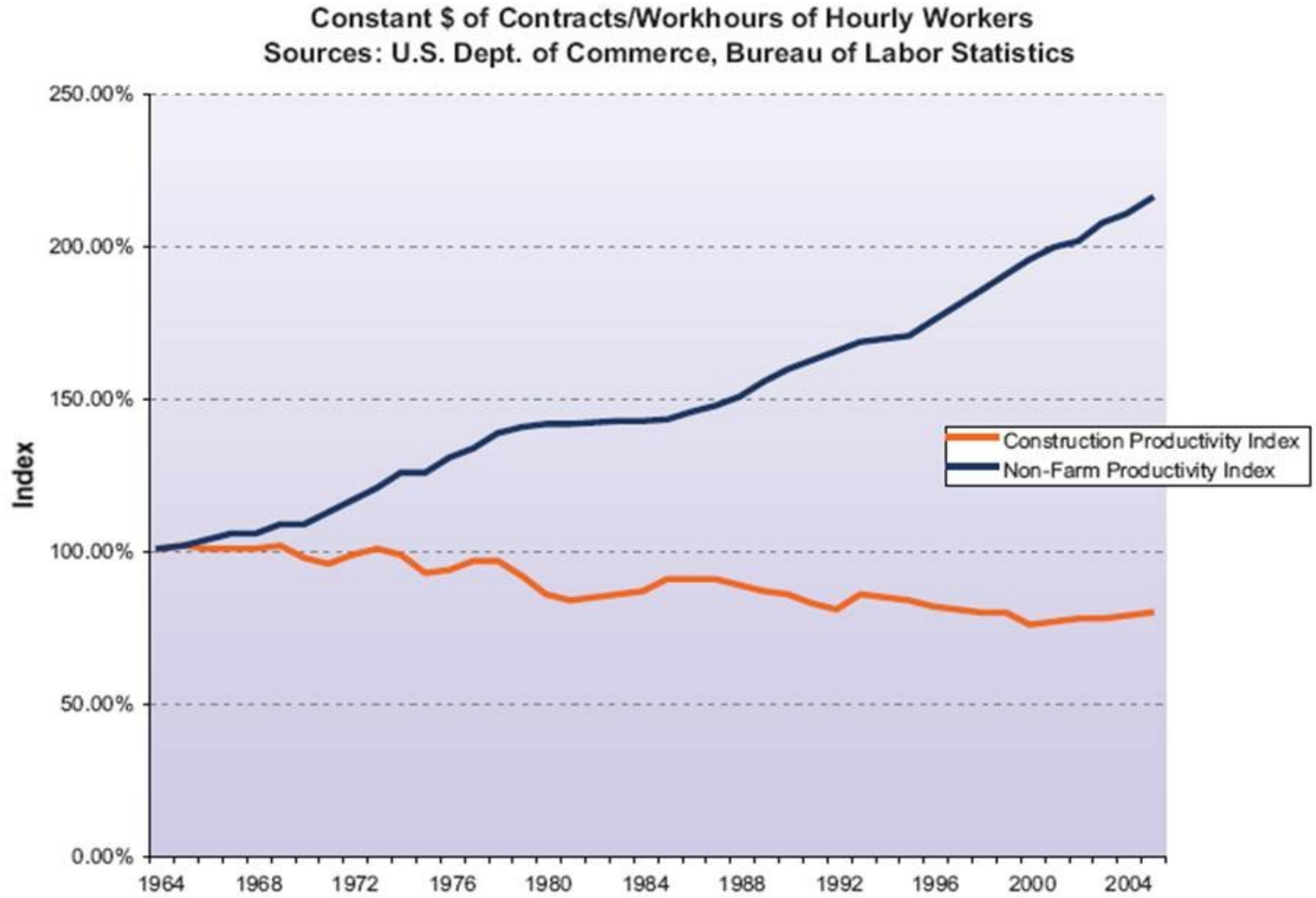
Ninety-eight percent of megaprojects face cost overruns or delays.



- **98% of projects** incur cost overruns or delays.
- The average **cost increase is 80%** of original value.
- The average **slippage is 20 months** behind original schedule.

Source: Companies' public annual reports; IHS Herold Global Projects Database, November 19, 2013; press releases

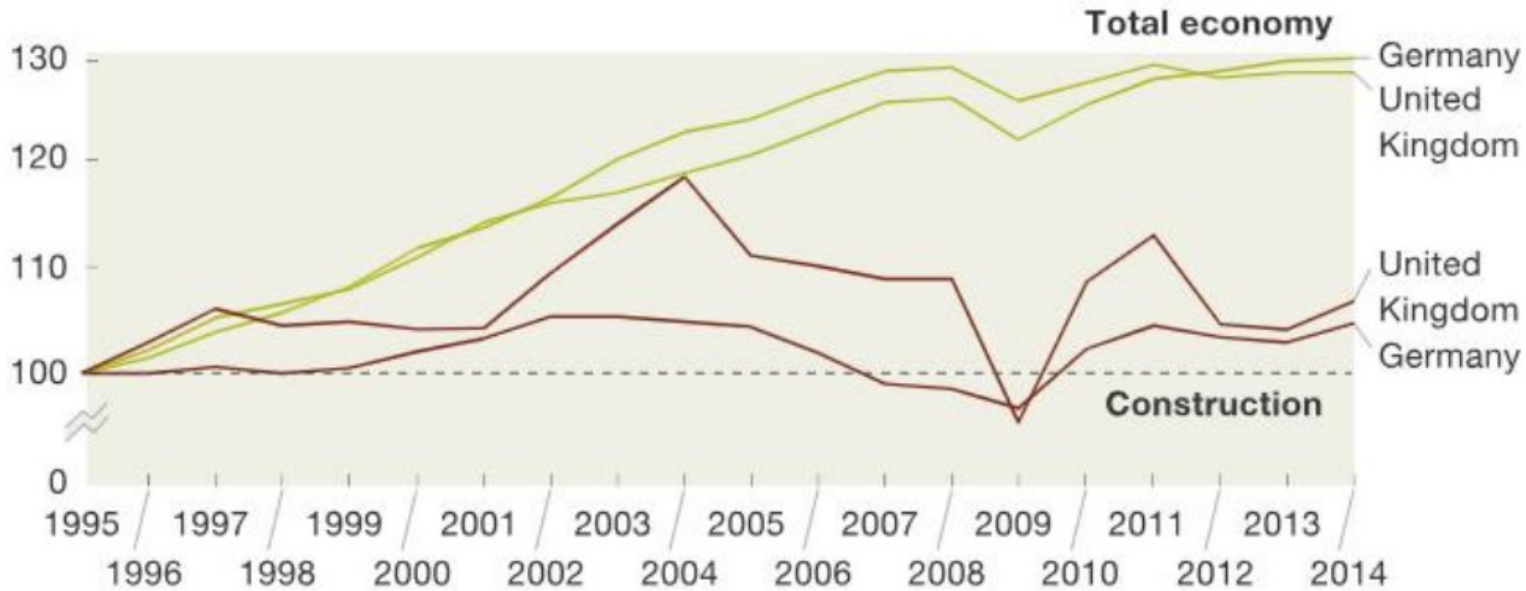
McKinsey&Company



Reference: Paul Teicholz, Ph.D., Professor (Research) Emeritus, Dept. of Civil and Environmental Engineering, Stanford University

Construction labor productivity has not kept pace with overall economic productivity.

Labor productivity, gross value added per hour worked, constant prices,[1]
index: 100 = 1995



[1]Based on 2010 prices.

McKinsey&Company | Source: Organisation for Economic Co-operation and Development

Growth Opportunities for the Global Construction Industry 2018-2023 - A Potential $10.5 Trillion Market

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NEWS PROVIDED BY
Research and Markets →
Jan 05, 2018, 05:30 ET

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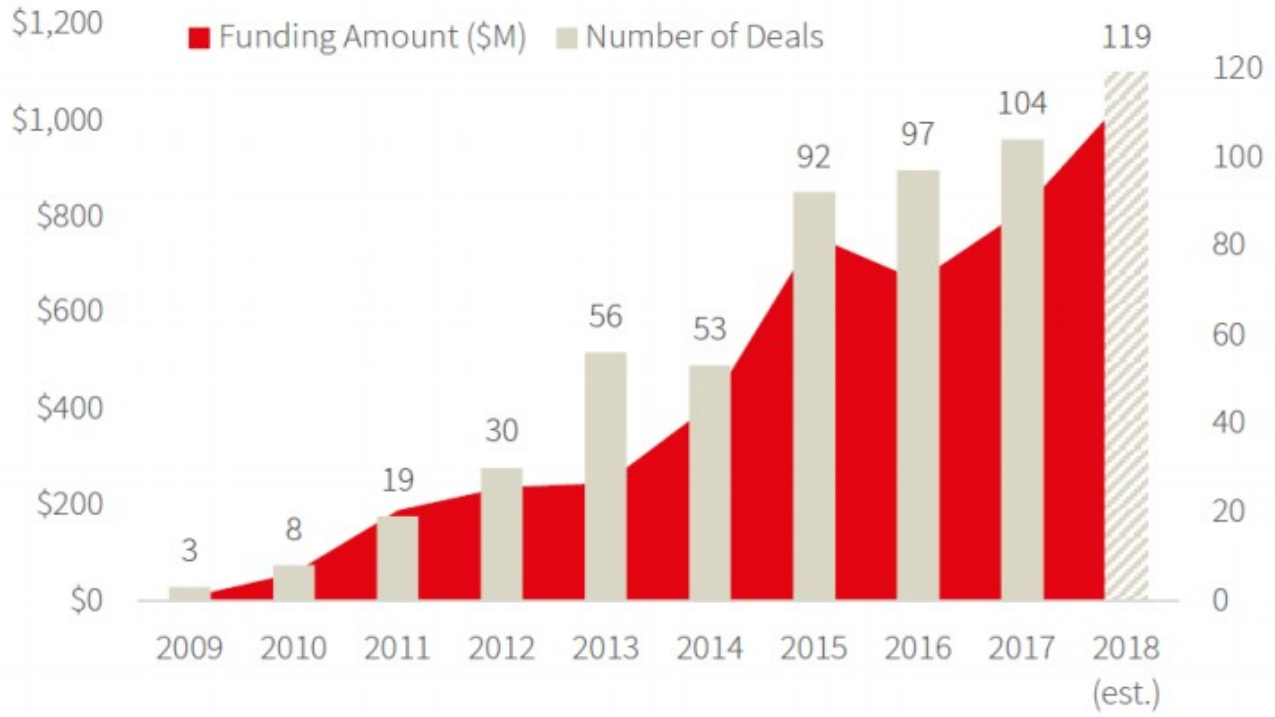
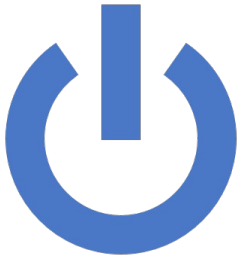
Just for the first half of 2018, venture capitalists have invested in construction technology more than **$1.05 billion dollars**

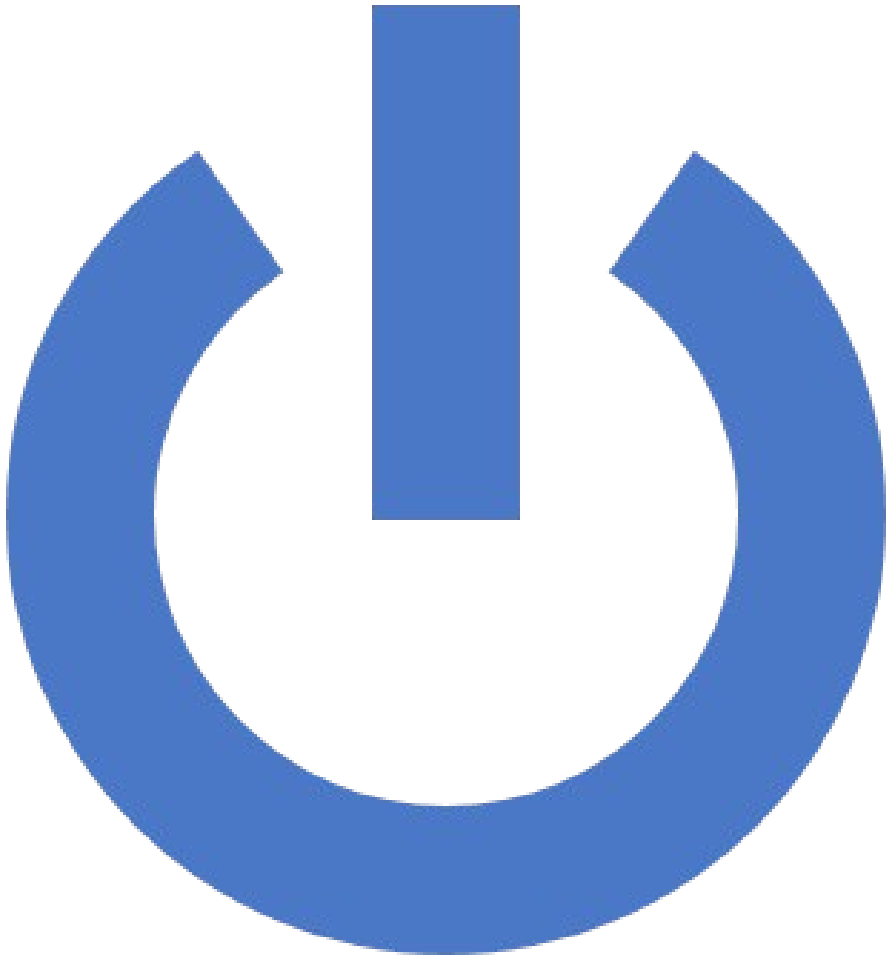
Construction startup and venture capital activity



Source: CB Insights, JLL Research



Design Evolution



- DEMO Video

Planning and Scheduling?

Critical Path Methodology

DEVELOPED IN THE 1950S

MANUAL OR COMPUTER BASED

NETWORK DIAGRAM

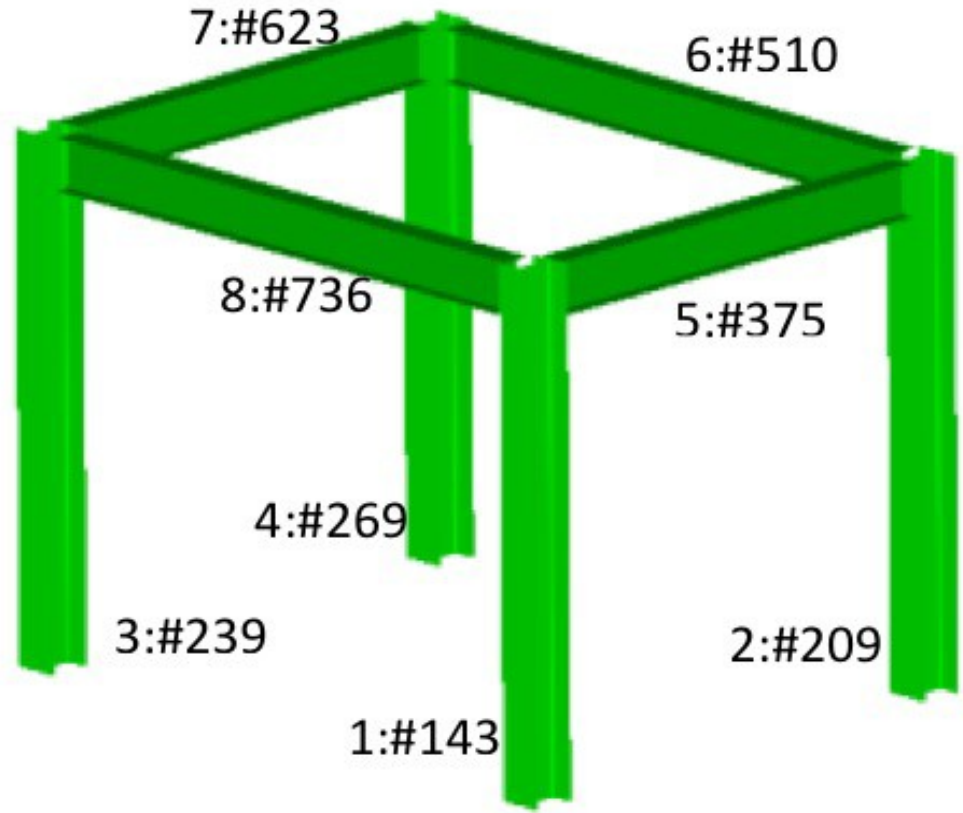
REPRESENTED IN GANTT CHAT FORMAT

3

3

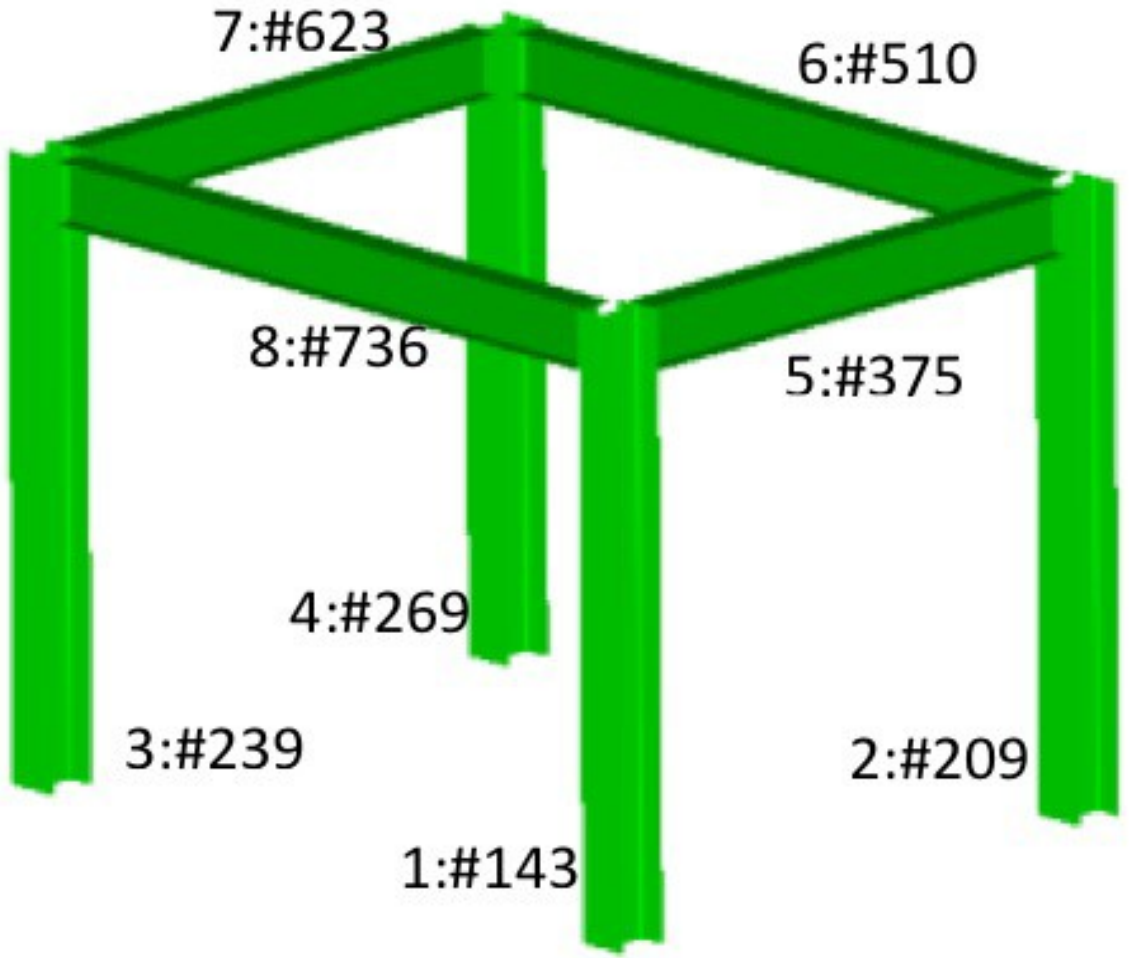
3

3

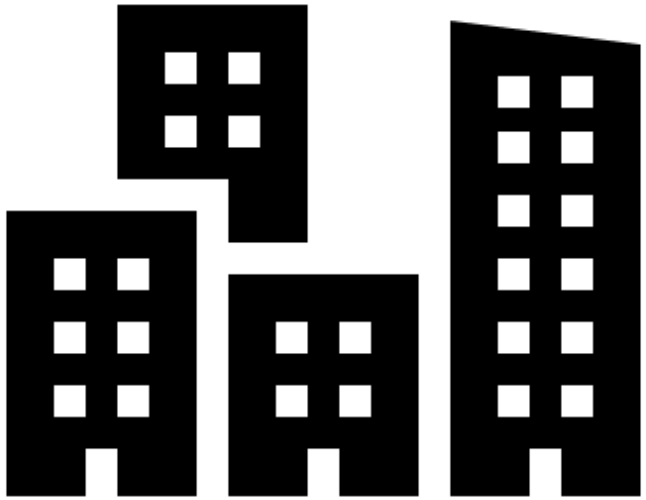


CPM Method

- List activities
- Estimate Durations
- Assign Dependencies (Sequencing)
- Assign Resources
- Review and Optimise



- CPM video



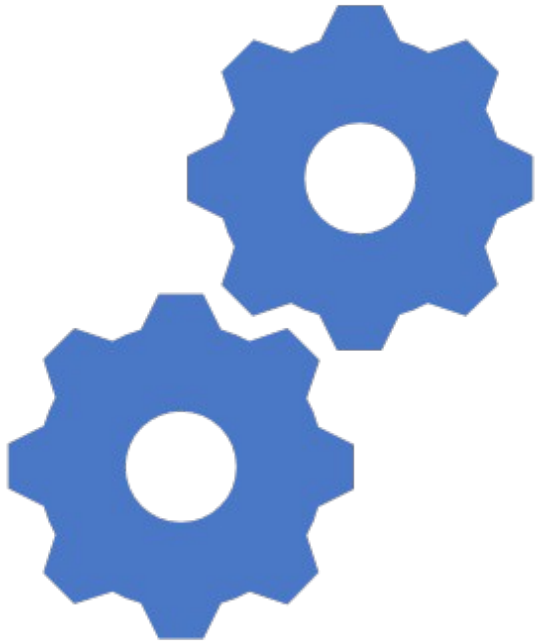
BIM / Model Based Planning

Plan directly from the 3D model

- 4D video

AI/Parametric Planning

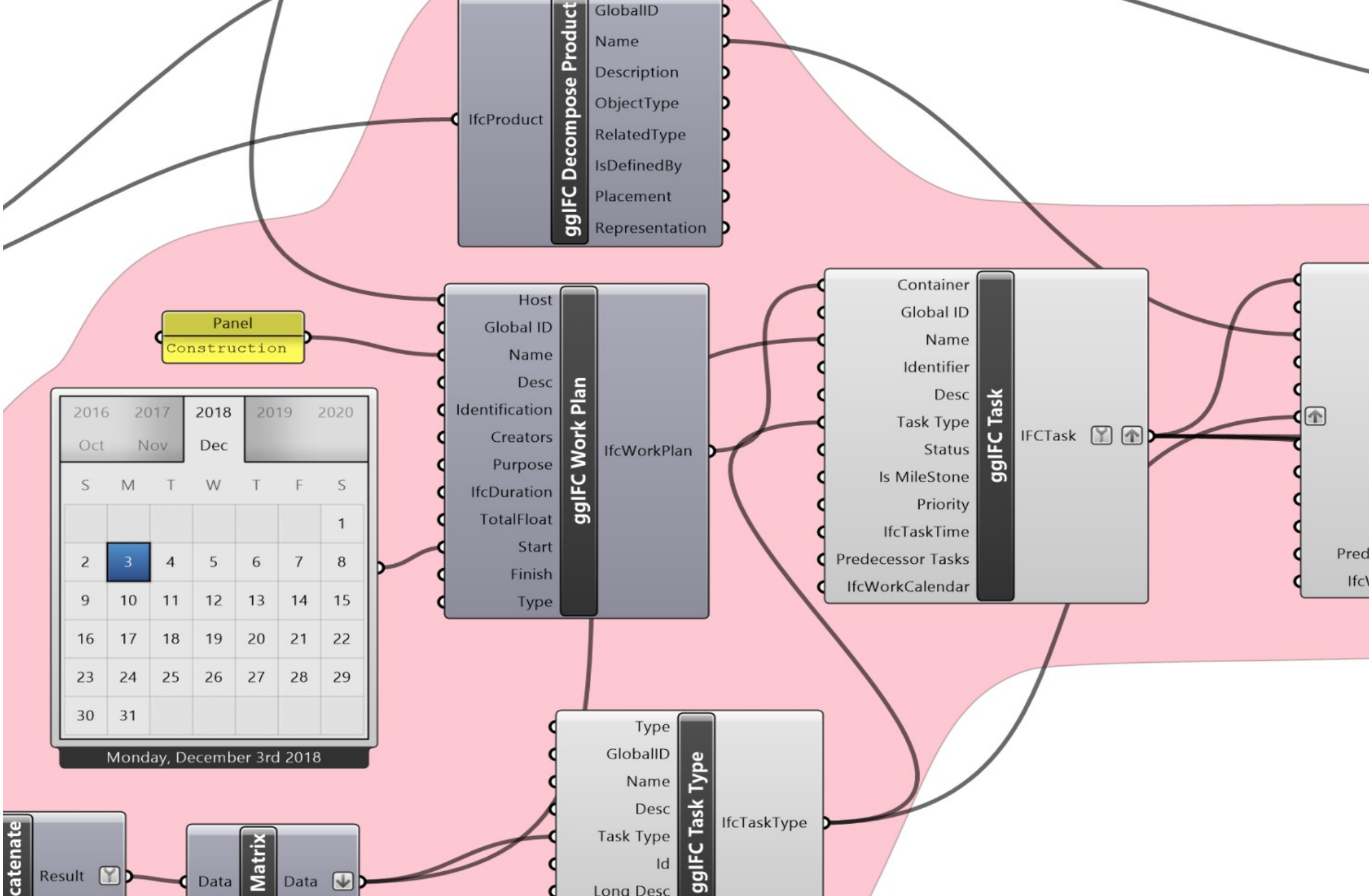
Fist time showing this video – developed for the conference !



Geometry rule based sequencing

Table 4- Stability Prerequisites Common Knowledge

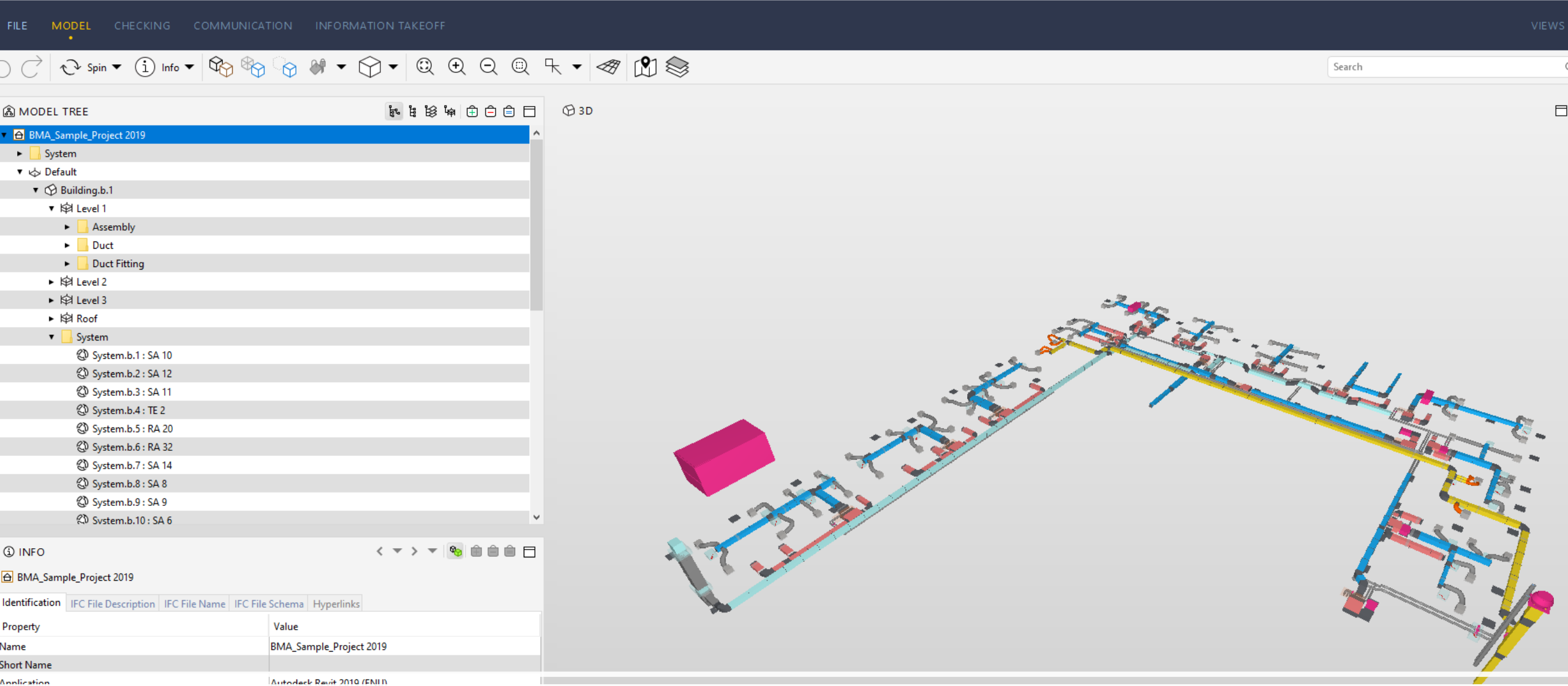
	Lower Level	Same Level	Upper Level
Column	Column	-	-
Beam	-	Supporting Columns or Beams	-
Wall	Beams	Adjacent Columns and Beams	-
Slab	Regional Beams	-	-
Roof	Regional Beams	-	-
Door	-	Container Wall	-
Window	-	Container Wall	-


GlobalID
Name
Description
ObjectType
RelatedType
IsDefinedBy
Placement
Representation
IfcProduct
ggIFC Decompose Product
Panel
Construction
Host
Global ID
Name
Desc
Identification
Creators
Purpose
IfcDuration
TotalFloat
Start
Finish
Type
ggIFC Work Plan
IfcWorkPlan
2016 2017 2018 2019 2020
Oct Nov Dec
S M T W T F S
1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31
Monday, December 3rd 2018
Container
Global ID
Name
Identifier
Desc
Task Type
Status
Is MileStone
Priority
IfcTaskTime
Predecessor Tasks
IfcWorkCalendar
ggIFC Task
IFCTask
Type
GlobalID
Name
Desc
Task Type
Id
Long Desc
ggIFC Task Type
IfcTaskType
Result
Data
Matrix
Data

DEMO - AI planning video 1

Can it be applied to real projects?

DEMO - AI structure video



What about a Mechanical Project with 1000’s of parts and different systems?

DEMO - AI HVAC video

ALICE Technologies - AI-Driven Parametric Construction Scheduler

Day 298
12-Apr-2019 @ 10:36
34%
9 Tasks 9 Crews

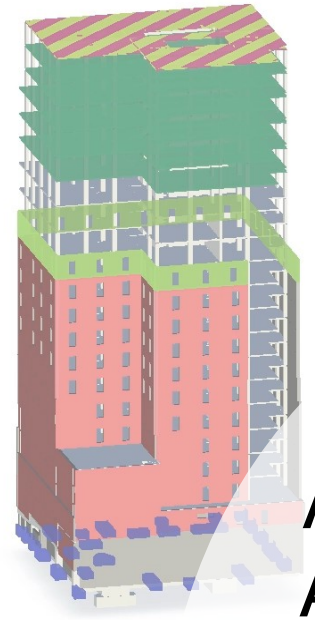
Curing
Curing
Level 16 Slabs
Actual Start **Tuesday 3/19/19 @ 9am**
Planned Finish *Monday 4/15/19 @ 5pm*
224 working / 656 total hours

Curing
Curing
Level 20 Slab
Actual Start **Wednesday 4/10/19 @ 9am**
Planned Finish *Tuesday 5/7/19 @ 5pm*
224 working / 656 total hours

Mason Crew
Procure Masonry
Floor [10850519]
Actual Start **Tuesday 6/19/18 @ 9am**
Planned Finish *Friday 4/12/19 @ 5pm*
1712 working / 7136 total hours

Form Crew
Form Slabs & Install Shores
Level 21 Slabs
Actual Start **Friday 4/12/19 @ 9am**
Actual Finish **Friday 4/12/19 @ 5pm**
8 working / 8 total hours

Rebar Crew
Reinforce
Level 21 Slabs
Actual Start **Friday 4/12/19 @ 9am**
Actual Finish **Friday 4/12/19 @ 5pm**
8 working / 8 total hours



8 selected of 215 elements

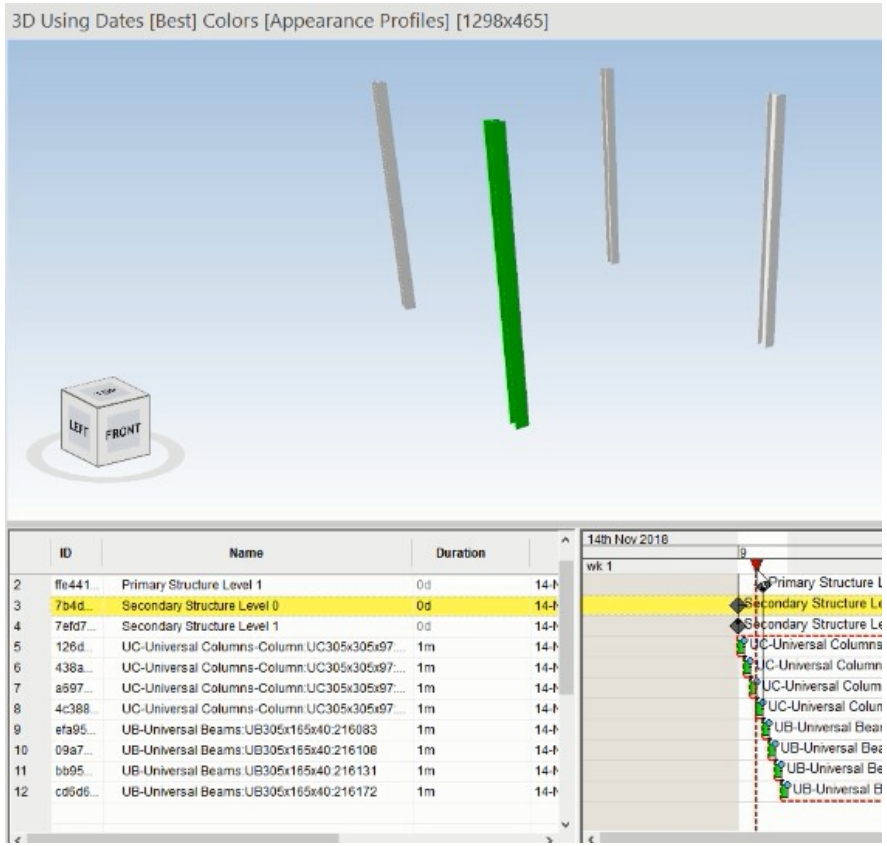
Schedule Point
15-Apr-2019 @ 00:00

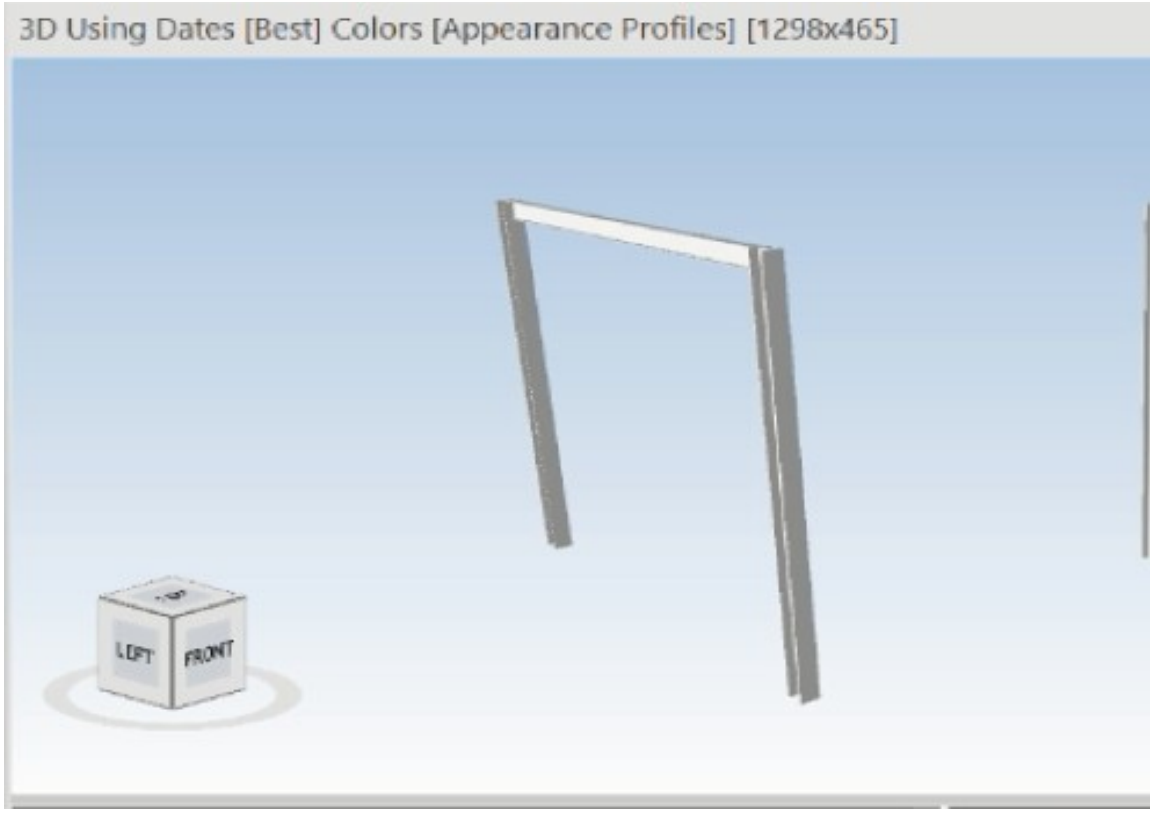
Mon 08 Tue 09 Wed 10 Thu 11 Fri 12 Sat 13 Sun 14 Mon 15 Tue 16

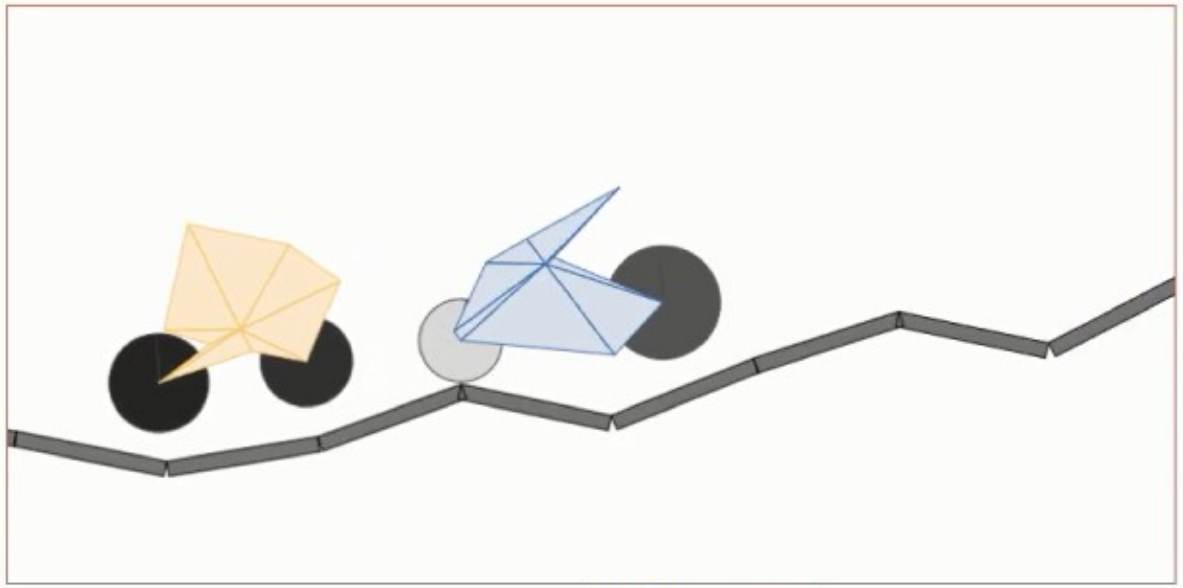
- Mason Crew
- Mobilization Crew
- Drilling Crew
- Excavation Crew
- Foundation Crew

Masonry,

Optimisation – Pieter v Algorithm







Donate

Save Population | Restore Saved Population

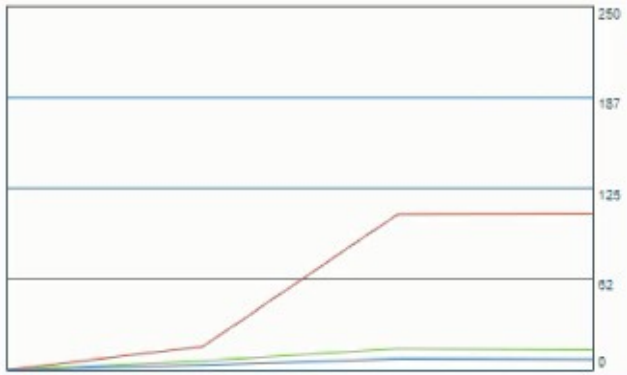
Surprise! | New Population

Fast Forward

Create new world with seed

Enter any string | Go!

Generation	3
Cars alive	2
Distance	62.3 meters
Height	2.17 meters
Mutation rate:	5%
Mutation size:	100%
Floor:	fixed
Gravity:	Earth (9.81)
Elite clones:	1



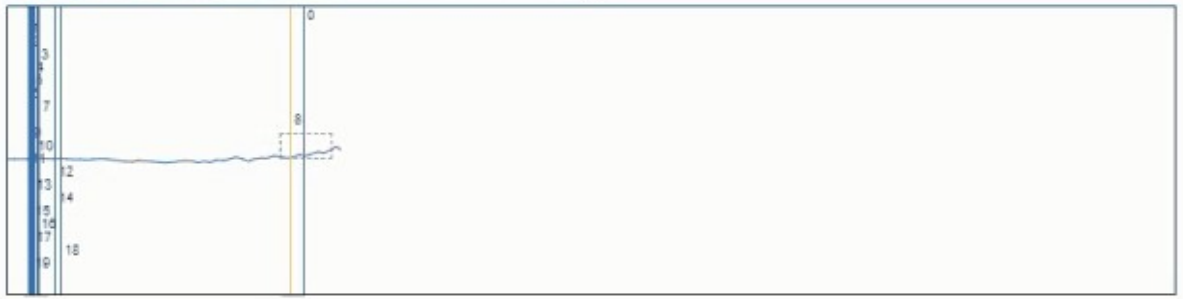
View top replay

Top Scores:

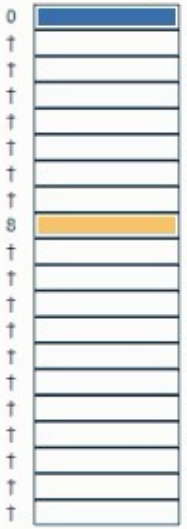
#1: 107.47 d:101.86 h:0/4.56m (Gen 2)

#2: 107.19 d:101.67 h:0/4.6m (Gen 1)

#3: 15.78 d:15.04 h:0/2.11m (Gen 0)



Watch Leader



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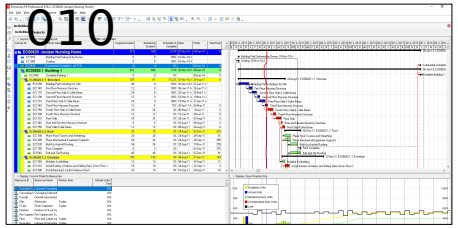
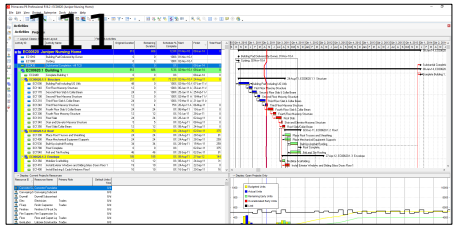
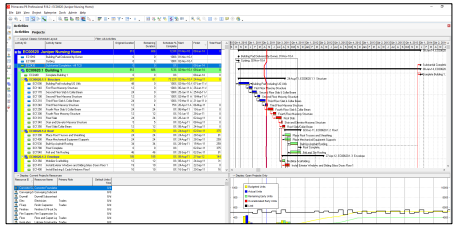
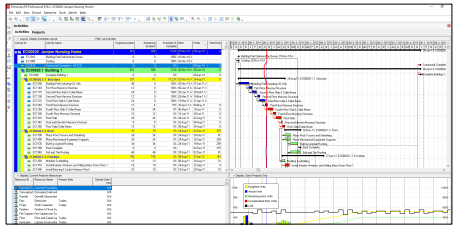
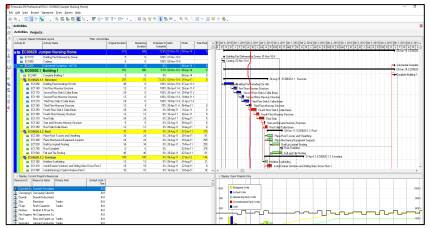
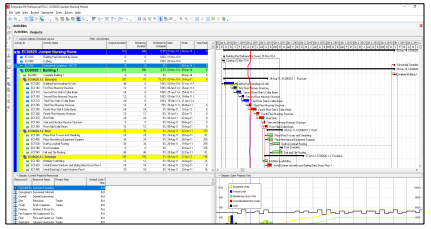
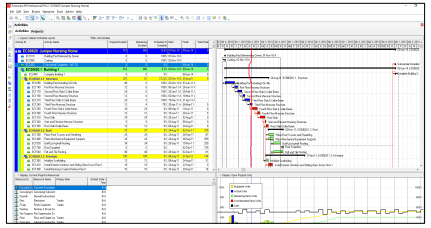
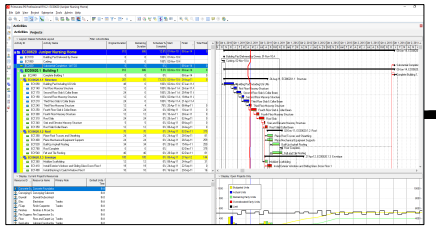
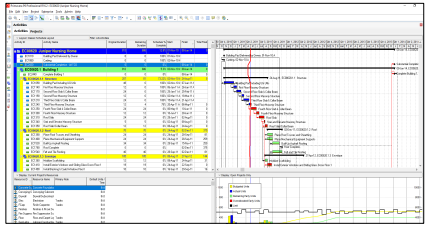
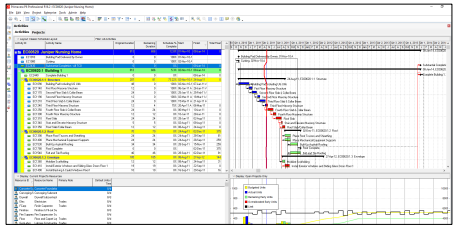
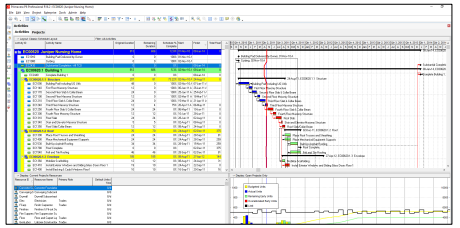
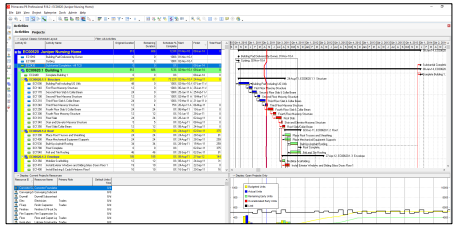
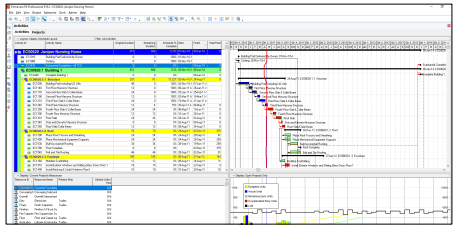
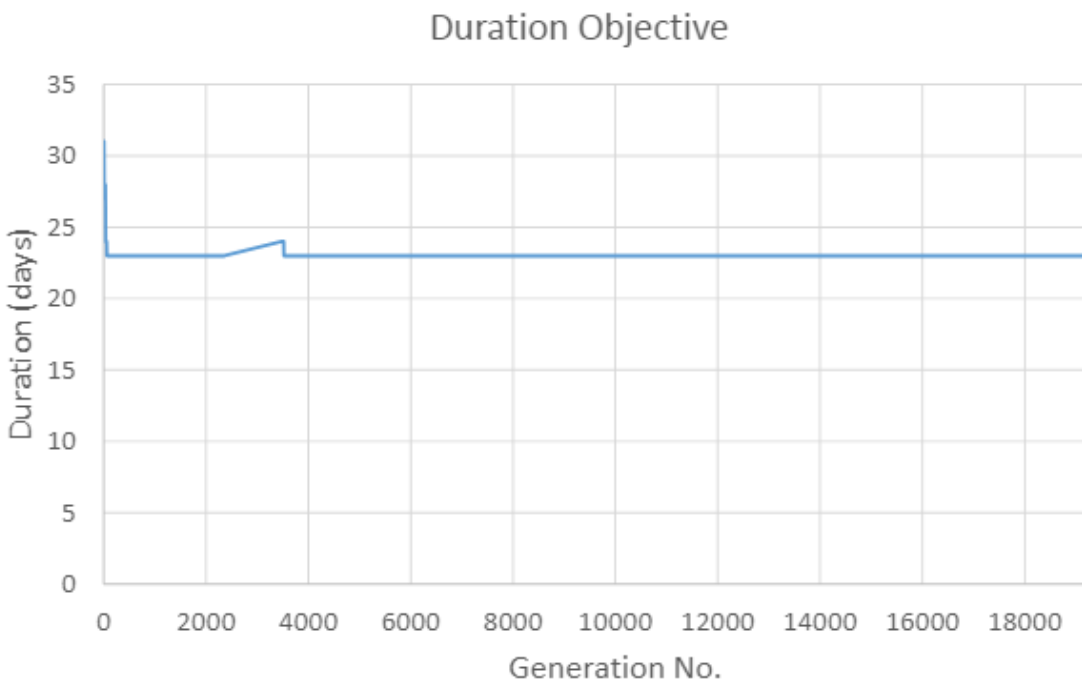
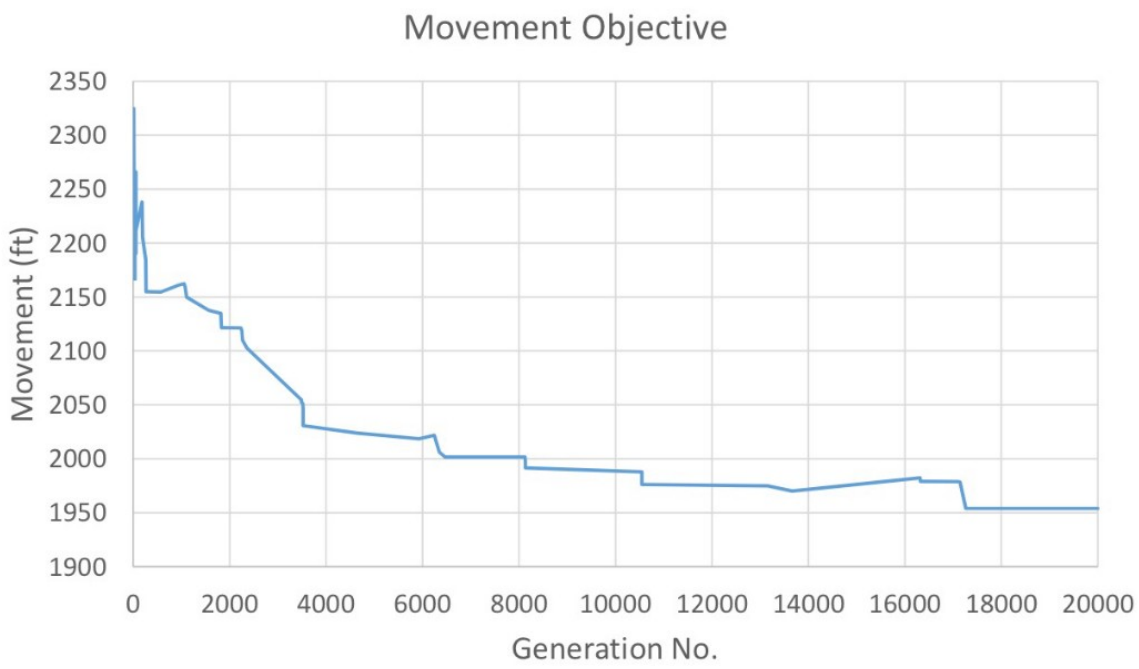
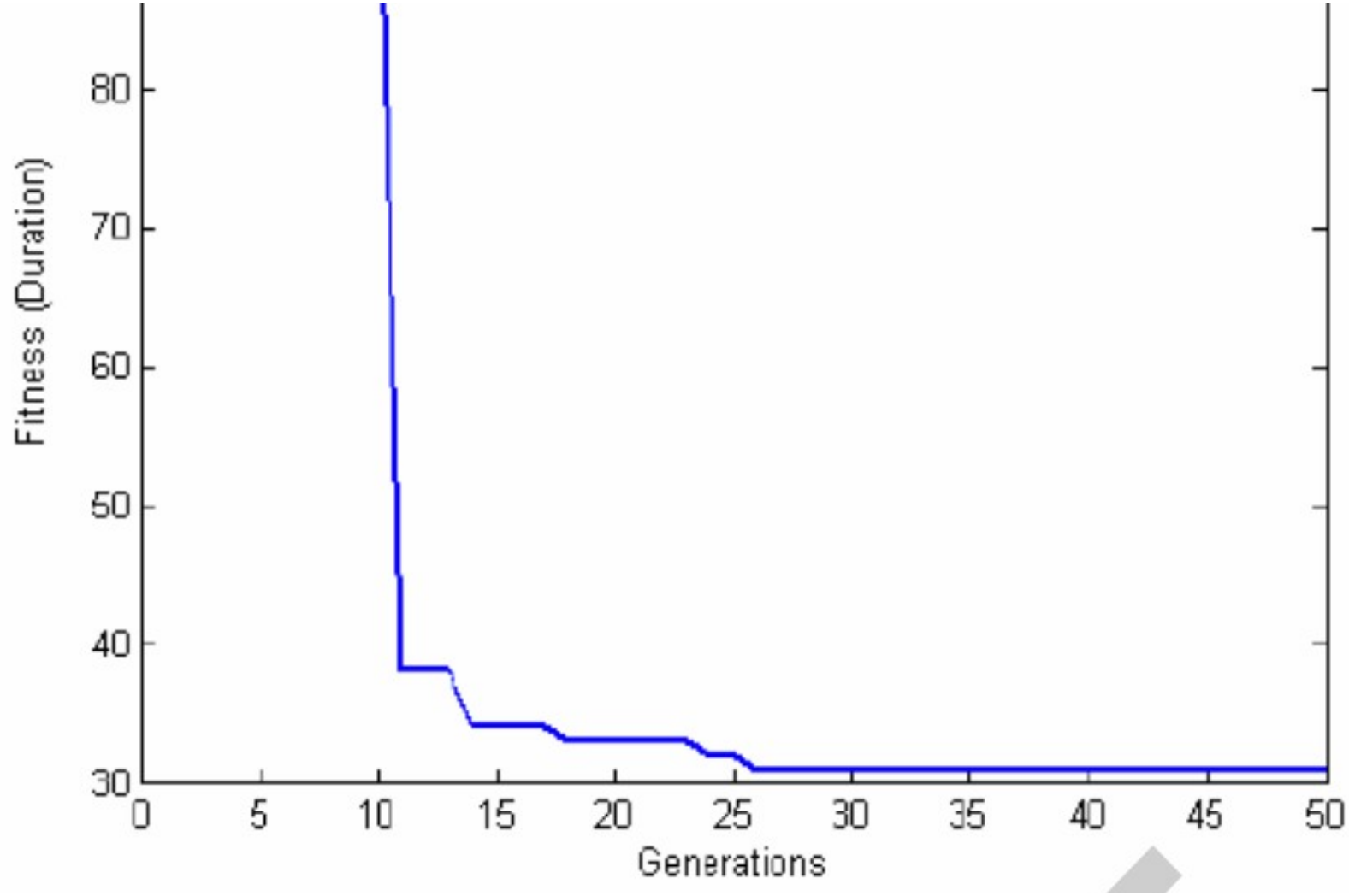
110111010101
111

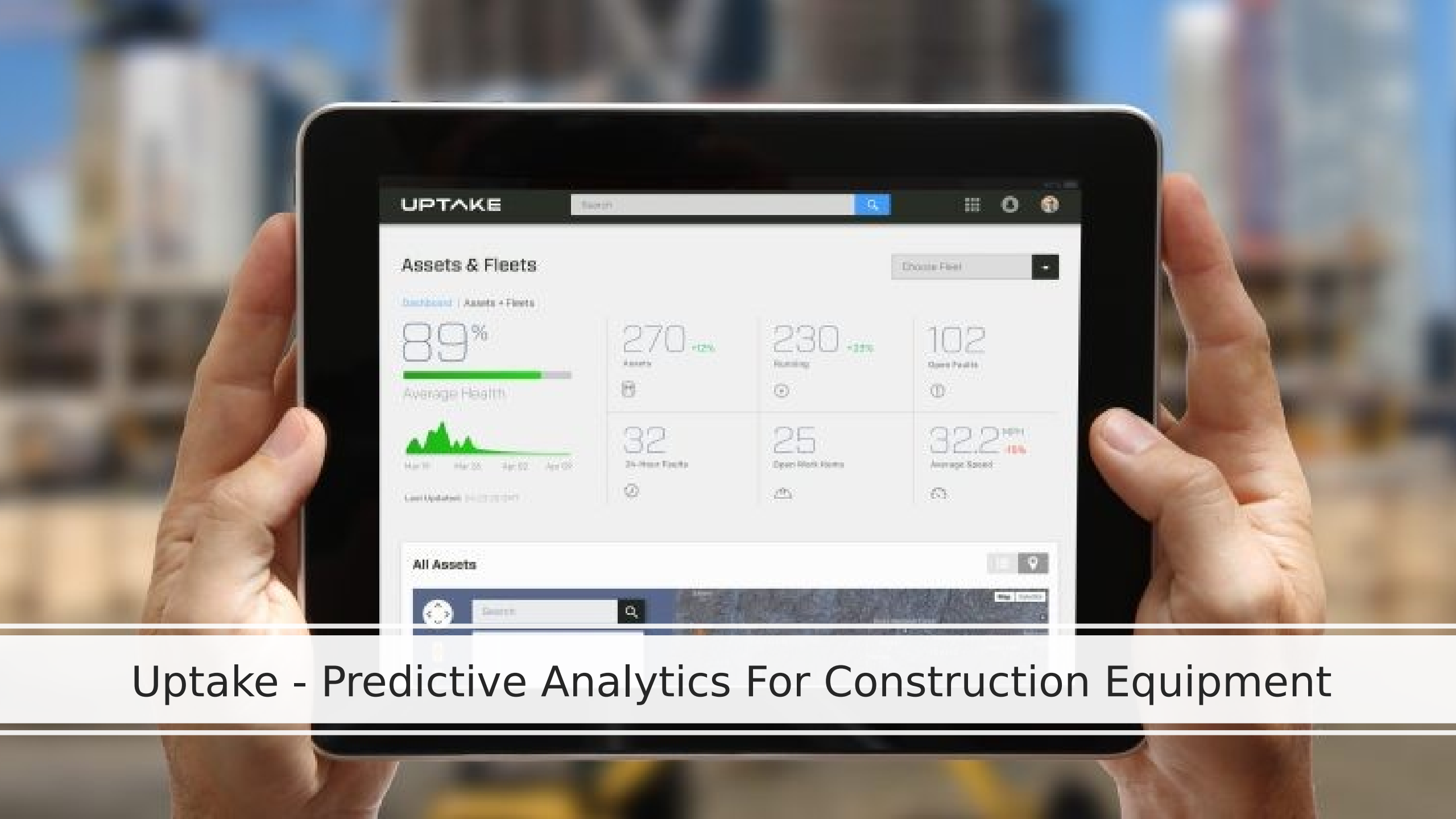

Duration Objective
Duration (days)
35
30
25
20
15
10
5
0
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
Generation No.


Movement Objective
Movement (ft)
2350
2300
2250
2200
2150
2100
2050
2000
1950
1900
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Generation No.

	the 1st generation	the 20,000th generation	improvements	
Duration	31 d	23 d	8 d	26%
(Labor) Cost	$35,310	$34,940	$370	1%
Movement	2,314 ft	1,954 ft	358 ft	15%

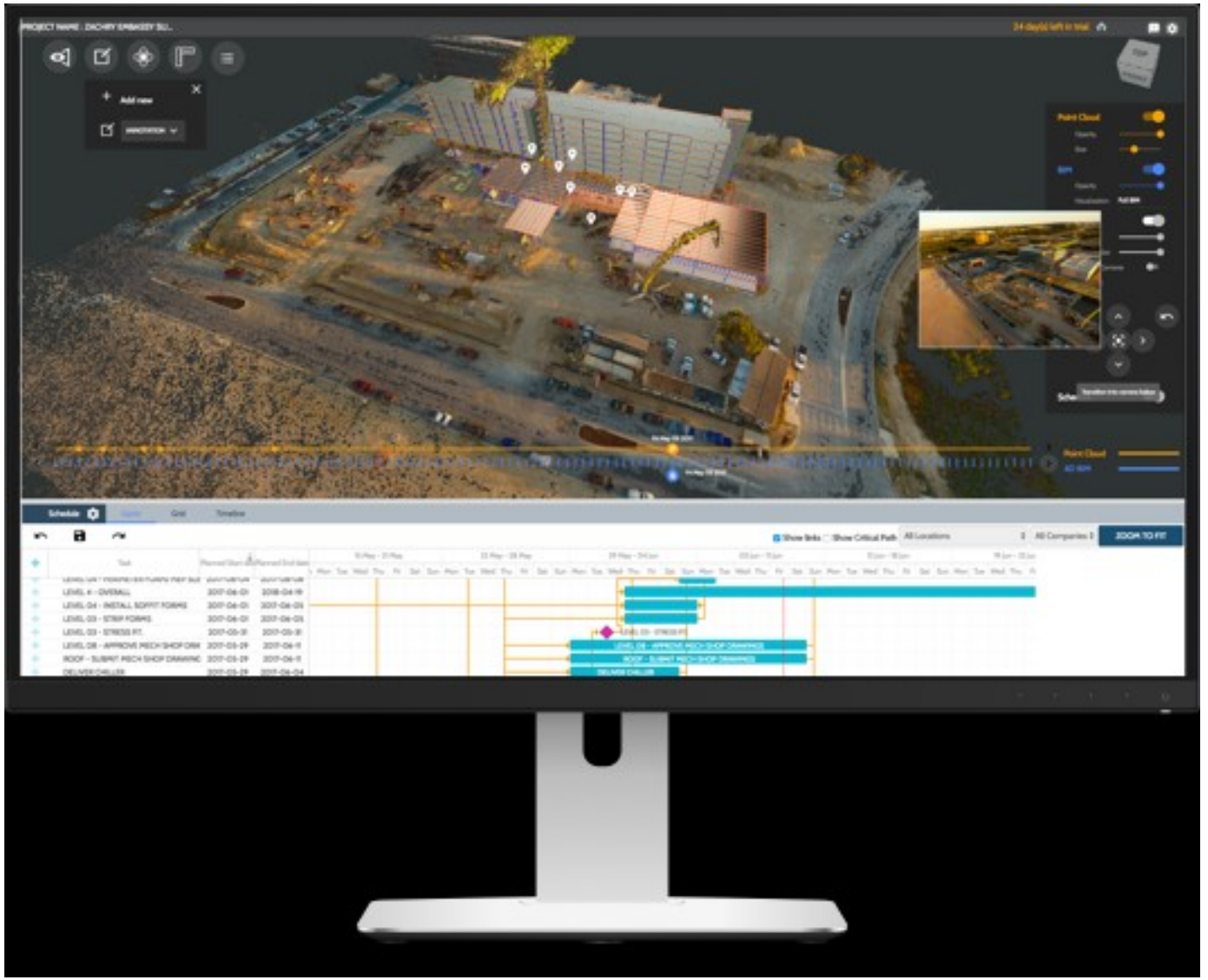


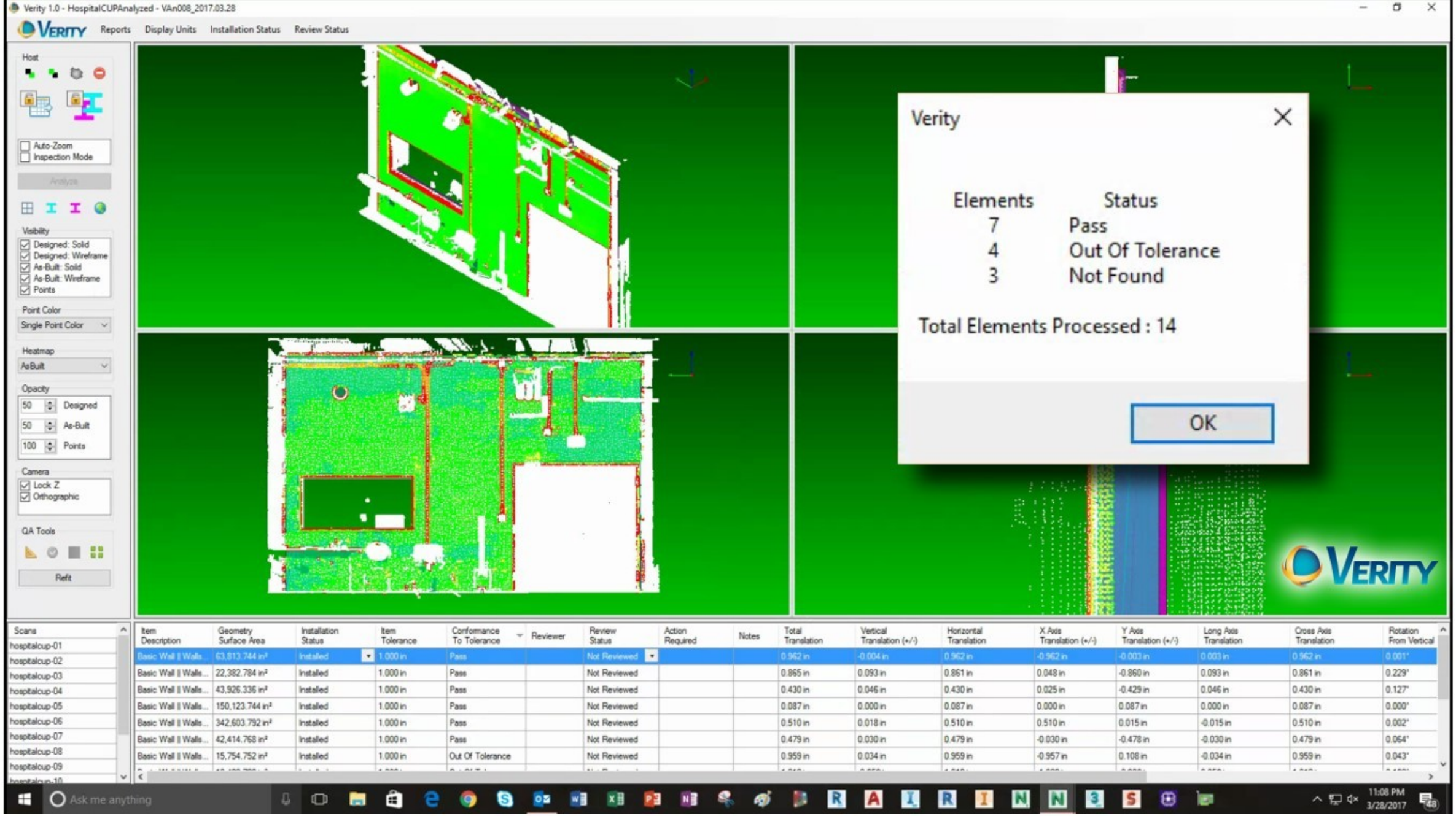
The potential role of Artificial Intelligence in project planning and the minimisation and mitigation of project



Uptake - Predictive Analytics For Construction Equipment

Reconstruct - AI for Construction Progress Monitoring





Verity verifies as-built structure, MEP, walls, fixtures and more against the design/fab model

Bechtel makes a game of its billion-dollar build projects

By Ry Crozier
Jun 29 2018
6:58AM

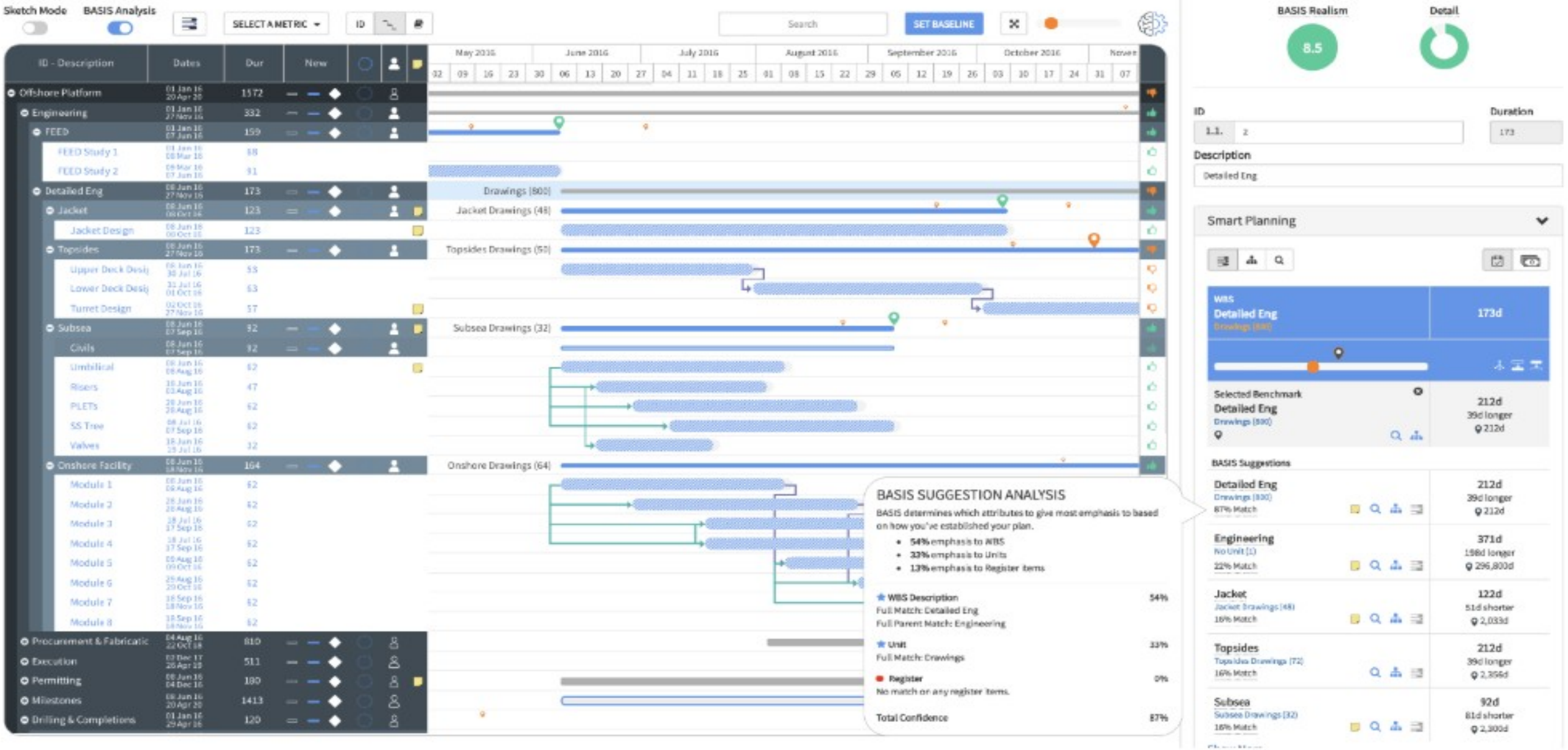
0 Comments

Engineering contractor turns to analytics.

Bechtel – which engineered some of Australia's largest liquefied natural gas projects – is turning to deep learning to sequence the construction of a new breed of multi billion dollar "mega" projects.

The privately held company is little known outside of the resources sector but has been in business about 120 years and has over 50,000 staff worldwide.

Bechtel's big data setup.


Sketch Mode
BASIS Analysis
SELECT A METRIC
ID
Search
SET BASELINE
ID - Description
Dates
Dur
New
May 2016
June 2016
July 2016
August 2016
September 2016
October 2016
Offshore Platform
Engineering
FEED
FEED Study 1
FEED Study 2
Detailed Eng
Jacket
Jacket Design
Topsides
Upper Deck Desig
Lower Deck Desig
Turret Design
Subsea
Civils
Umbilical
Risers
PLETs
SS Tree
Valves
Onshore Facility
Module 1
Module 2
Module 3
Module 4
Module 5
Module 6
Module 7
Module 8
Procurement & Fabricatic
Execution
Permitting
Milestones
Drilling & Completions
Drawings (800)
Jacket Drawings (48)
Topsides Drawings (50)
Subsea Drawings (32)
Onshore Drawings (64)
BASIS SUGGESTION ANALYSIS
BASIS determines which attributes to give most emphasis to based on how you've established your plan.
54% emphasis to WBS
33% emphasis to Units
13% emphasis to Register Items
WBS Description
54%
Full Match: Detailed Eng
Full Parent Match: Engineering
Unit
33%
Full Match: Drawings
Register
0%
No match on any register items.
Total Confidence
87%
BASIS Realism
8.5
Detail
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2
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173
Description
Detailed Eng
Smart Planning
WBS
Detailed Eng
Drawings (800)
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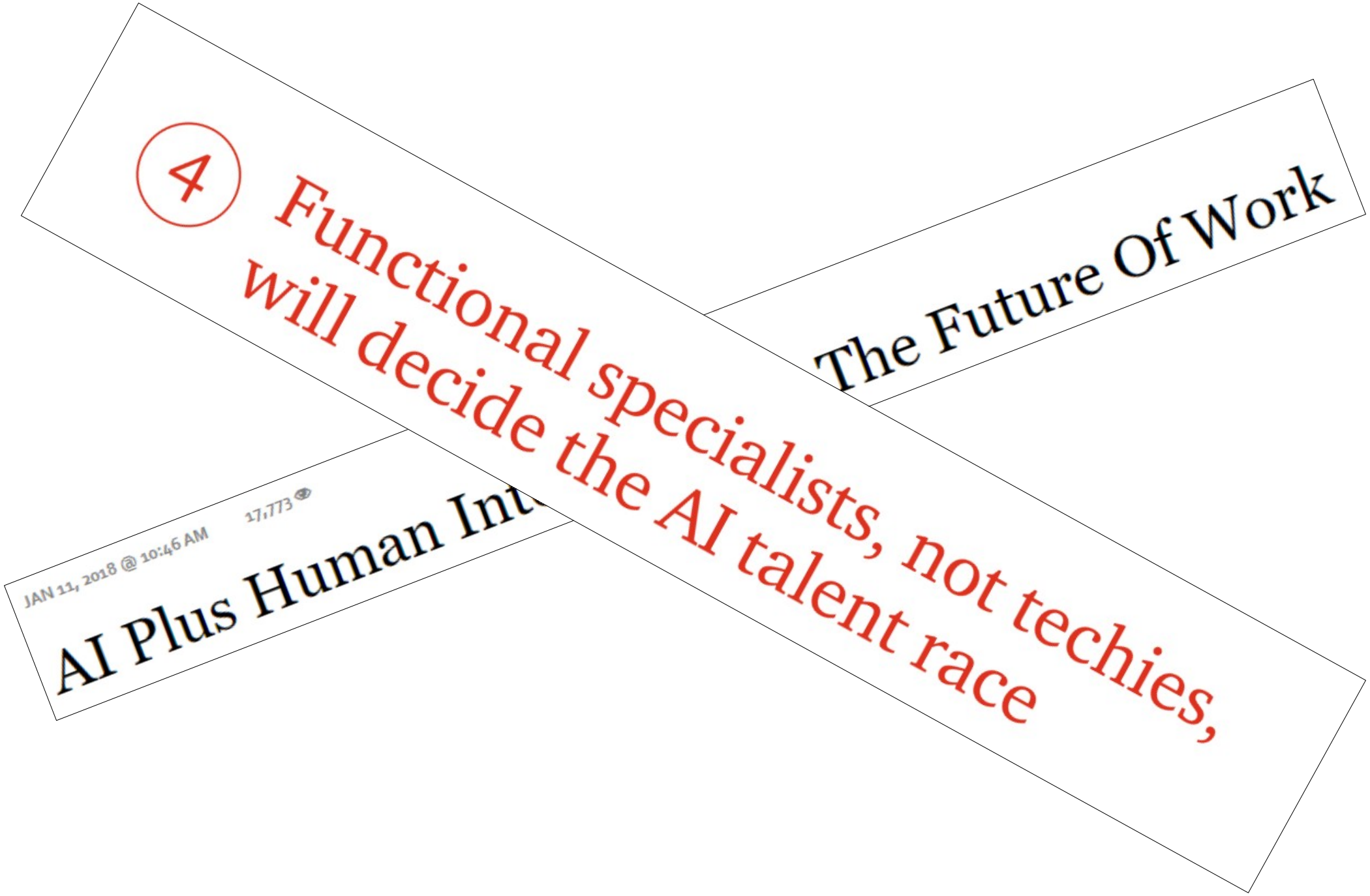
Selected Benchmark
Detailed Eng
Drawings (800)
212d
39d longer
212d
BASIS Suggestions
Detailed Eng
Drawings (800)
87% Match
212d
39d longer
212d
Engineering
No Unit (1)
22% Match
371d
198d longer
296,800d
Jacket
Jacket Drawings (48)
16% Match
122d
51d shorter
2,033d
Topsides
Topsides Drawings (72)
16% Match
212d
39d longer
2,356d
Subsea
Subsea Drawings (32)
16% Match
92d
81d shorter
2,300d

Video

Video


4
Functional specialists, not techies, will decide the AI talent race
The Future Of Work
JAN 11, 2018 @ 10:46 AM
17,773
AI Plus Human Int

The time to act is now

But How?

01

Automate tasks that are:

1. Rules based
2. Manual
3. Repetitive

02

Self educate –

Brush up on data analytics skills – Khan Academy, Learn to code – SQL, Udemy, Code Academy, MOOCs

03

Collaborate with:

- Project Controls peers
- 3D designers
- Architects
- Programmers
- Nerds

#4cast4d

4 | 0 | Add a topic

Monday, May 21st

Tuesday, May 22nd

Kieran Shirey 12:25 AM
@Pieter wow! That looks great. And really starting to show where this is headed. Can't wait to show this off to some of the delegates here. Brilliant work mate. Thank you.

Wednesday, May 23rd

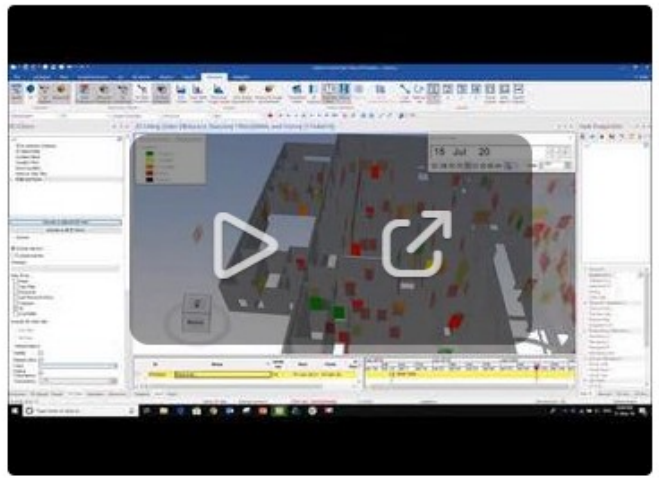
Kieran Shirey 1:28 PM
It certainly attracted a lot of attention. I think we need to keep developing this because we could have some major opportunities around the corner.

Pieter 9:24 PM
That is really great news mate (edited)

Wednesday, May 30th

Pieter 7:52 PM
@Joshua Shanahan here is a link ot he cut down version of what we currently have https://youtu.be/pAunNdCx9a4

YouTube | Kieran Shirey
4Cast 4D



Message #4cast4d

Future Project Controls Professional?

1. Seen as a source of trust – strong human connections
2. Understands where to apply AI and when to apply human intelligence
3. Highly adaptable, agile and collaborative